Padilla Bay National
Estuarine Research Reserve
Breazeale Interpretive Center

THE ESTUARY GUIDE

LEVEL 1

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If you have special accomodation needs,
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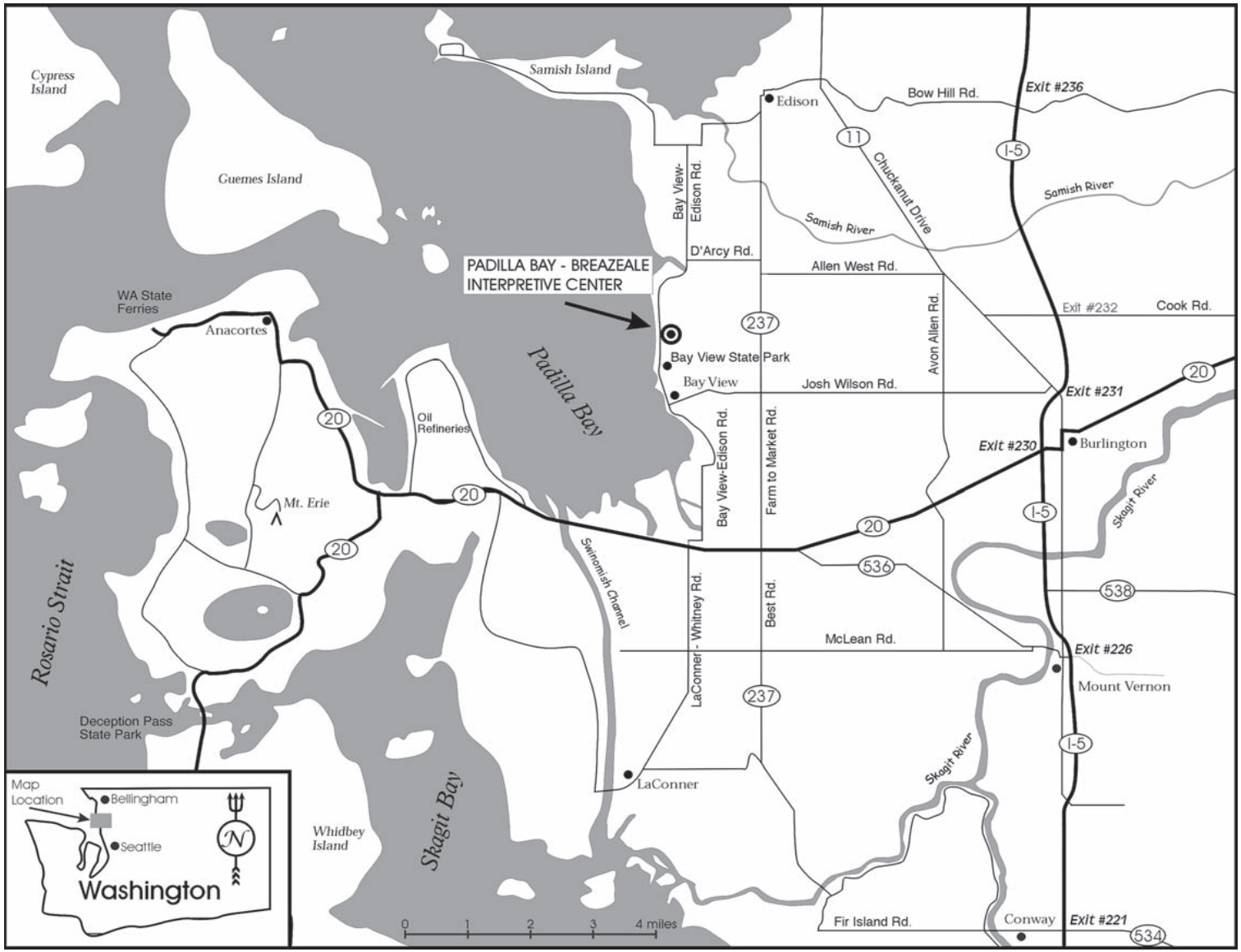
Publication No. 02-06-006
Revised 2002

This document was made possible by a grant to Washington State Department of Ecology with funds from NOAA's Office of Ocean and Coastal Resource Management.

Table of Contents


Cypress Island
Samish Island
Guemes Island
Edison
Bow Hill Rd.
Exit #236
I-5
11
Chuckanut Drive
Samish River
Bay View-Edison Rd.
D'Arcy Rd.
PADILLA BAY - BREAZEALE INTERPRETIVE CENTER
Allen West Rd.
WA State Ferries
Anacortes
237
Bay View State Park
Bay View
Josh Wilson Rd.
Avon Allen Rd.
Exit #232
Cook Rd.
Exit #231
20
Padilla Bay
Oil Refineries
Bay View-Edison Rd.
Farm to Market Rd.
Exit #230
Burlington
Mt. Erie
Skagit River
Rosario Strait
Swinomish Channel
536
538
LaConner - Whitney Rd.
Best Rd.
McLean Rd.
Exit #226
Mount Vernon
Deception Pass State Park
LaConner
Skagit Bay
Whidbey Island
Map Location
Bellingham
Seattle
Washington
0 1 2 3 4 miles
Fir Island Rd.
Conway
Exit #221
534

Introduction

This guide is designed for use by teachers of primary grades to complement a visit to the Padilla Bay National Estuarine Research Reserve. It is also a useful resource to anyone teaching about watersheds, estuaries, shorelands, and coastal resources.

It is divided into four sections:

- Pre-trip information and activities
- On Site materials
- Post-trip ideas
- Resources

A variety of activities is included, designed to weave together many subjects and many ways of learning. Our hope is that some will fit comfortably into your class work and with your unique style of teaching.

There is a wealth of beauty, humor and truths stranger-than-fiction out there waiting to be understood. May these beginning activities lead to a closer bonding between people and the natural world.

Padilla Bay has been designated as a National Estuarine Research Reserve, managed by the Washington State Department of Ecology in cooperation with the National Oceanic and Atmospheric Administration (NOAA). One of 25 reserves around the country, Padilla Bay is set up as a natural field laboratory for research and education, with the goal of enhancing public awareness of the value of estuaries and improving coastal resource management.

Teacher Checklist

Pre-trip:

___ Read through this curriculum packet.

___ Arrange for adequate adult supervision. (We suggest one adult for every 5-8 children.)

___ Prepare adults by giving them the Parent Page on pages 32-33. Be sure drivers have the map on page iv.

___ Make legible name tags for all.

___ If you will be visiting the beach, emphasize the importance of warm outdoor clothing: warm jackets, rain gear, hats, and gloves during October - May. Snug boots or old shoes that tie are best for low tide dates.

___ Consider using one or more of the pre-trip activities on pages 7-27. Prepared students benefit most from our program.

___ If you will be visiting the beach at Bay View State Park on your own, please read through "At the Beach" on pages 34-36.

On Site:

___ Are your students wearing name tags?

___ Please arrive at your scheduled time or call to let us know of a change.

___ Enjoy!

Post-trip:

___ Continue the estuary studies back in your classroom with some of the many activities listed on pages 39-78 of this curriculum.

___ If you have suggestions for any improvements or changes we could make to our program, please write or call (360)428-1558.

___ Our programs are supported by State and Federal funds as well as a nonprofit foundation. We encourage groups to join or make a donation to:

The Padilla Bay Foundation
PO Box 1305
Mount Vernon, WA 98273

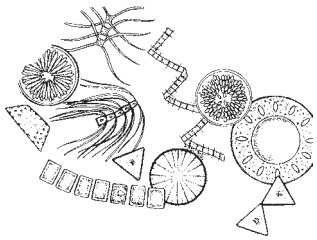
A Bit About Estuaries ...

The Skagit River begins in the North Cascades. It tumbles down mountain sides, spills over waterfalls, runs past towns and under bridges, winds through the fertile Skagit Valley and eventually slows down as it nears its estuary, the Skagit Delta. An estuary: the place where a river meets the sea.

Estuaries are remarkable places, rich with treasures hidden to the casual observer. Life is concentrated here. The amount of plant material produced in an estuary far exceeds that of even our best-tended wheat fields. In turn, plants provide food and shelter for a myriad of animals. The bay is a veritable garden.

Plants

The complex marine food web begins with phytoplankton, the tiny, free-floating plants that thrive in the shallow, sunlit, nutrient-rich water. Phytoplankton belong to a group of plants called algae. Large algae is commonly called seaweed.



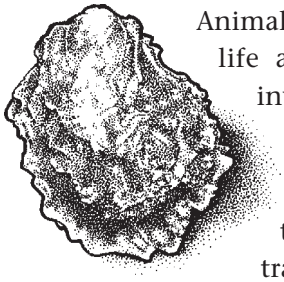
Another producer is eelgrass, a flowering marine plant which carpets Padilla Bay. It offers food and shelter to the many animals that live on and among its blades. Eelgrass is valuable both as habitat while it is living, and as a food once it has died and decayed.

A third major group of plants consists of the salt marsh plants that form the transition zone between land and water. These specialized plants add nutrients to the bay, filter out toxins from land runoff, and soak up excess rainwater like a sponge.

A Bit About Estuaries ...

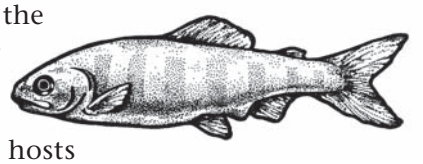
Animals

The abundant plant life in an estuary attracts incredible numbers of animals, for it provides ample food and shelter. Estuaries can be a home, a nursery or a rest stop for migrating animals.



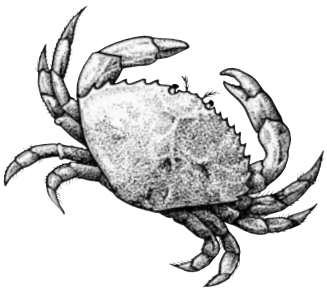
Animals such as oysters, clams, worms, crabs, and snails begin their life as zooplankton and settle down as they mature. These invertebrates provide food for larger animals such as birds and fish.

Salmon need to spend time in an estuary on their journey to the sea. The bay provides food, protective shelter, and a gentle transition stage from the fresh water to the salt. Juvenile Dungeness crab, herring, and flounder are some of the many animals found in large numbers in the shallow waters of the estuary.



Padilla Bay is located along a major flyway and hosts thousands of migrating birds, including shorebirds, ducks, brant geese, and raptors such as eagles and falcons. Some choose to winter here, while others continue southward.

"Estuary" comes from the Latin word *aestus*, meaning *tides*. Twice a day the tides fill and empty the bay. Seasonal cycles and daily fluctuations of tides, salinity and temperature create a unique environment that can be incredibly stressful to its inhabitants. Species that have adapted to the stresses tend to be numerous, attesting to the high productivity and natural wealth in an estuary.



A Bit About Estuaries ...

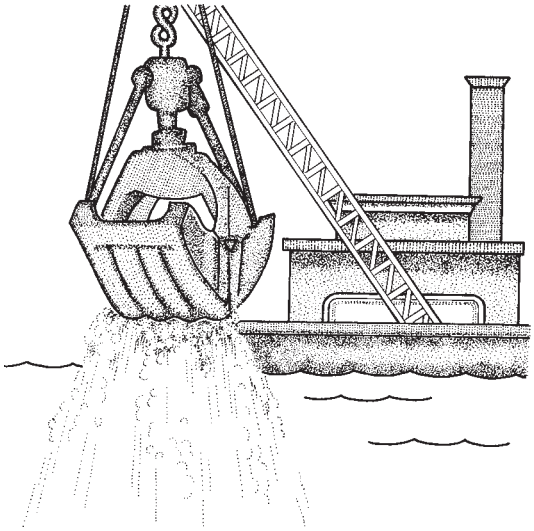
People

People are much like birds. We, too, "flock" to estuaries for the natural resources, edible as well as aesthetic, and for the ease of transportation by land, water and air. The scenic backdrop for recreational activities and the peace and beauty at the water's edge lure us. More than half of the U.S. population resides near an estuary. Most of the people in Washington state live on the coast, near an estuary (Puget Sound)— and these numbers are steadily increasing.

Growing appreciation is a mixed blessing. Estuaries have been used and much abused in the past. Seen as barren and muddy wastelands, they have been targeted sites for dredging, diking, and dumping of wastes. Development is often accompanied by habitat loss, polluted runoff, increased erosion, and other water quality problems.

There are many things individuals can do to change this trend. Learning more about estuaries is a good first step, followed by a close examination of our own decisions and behaviors that affect estuaries.

We are glad you are here to learn with us.



Pre-trip

by Tessa

Introducing Your Class to Estuaries

- Lead a discussion. When introducing your class to estuaries, begin with the familiar. Ask about their experiences that may connect with estuaries.

  Do you live near a river or beach?

  Have you ever visited an estuary?*

  What have you seen or done there?

  What did it look like?

  What plants or animals did you see there?

  Do you ever go boating?

  Do you catch fish?

  Was the water fresh or salty? (Don't discount fresh water experiences.)

  If you live near a river or stream, find out where you would end up if you floated down river in a boat.

- Read a story. Many good ones are listed on page 83.
- Sing a song. Check pp. 73-79.

* Most of the groups that come to Padilla Bay live right by an estuary, though they may not realize it. Puget Sound is one very large estuary. That means that everyone near Puget Sound is near an estuary! Let your students know that an estuary is not necessarily some muddy, marshy, far away place. It may be right next door!

Where Is My Home?

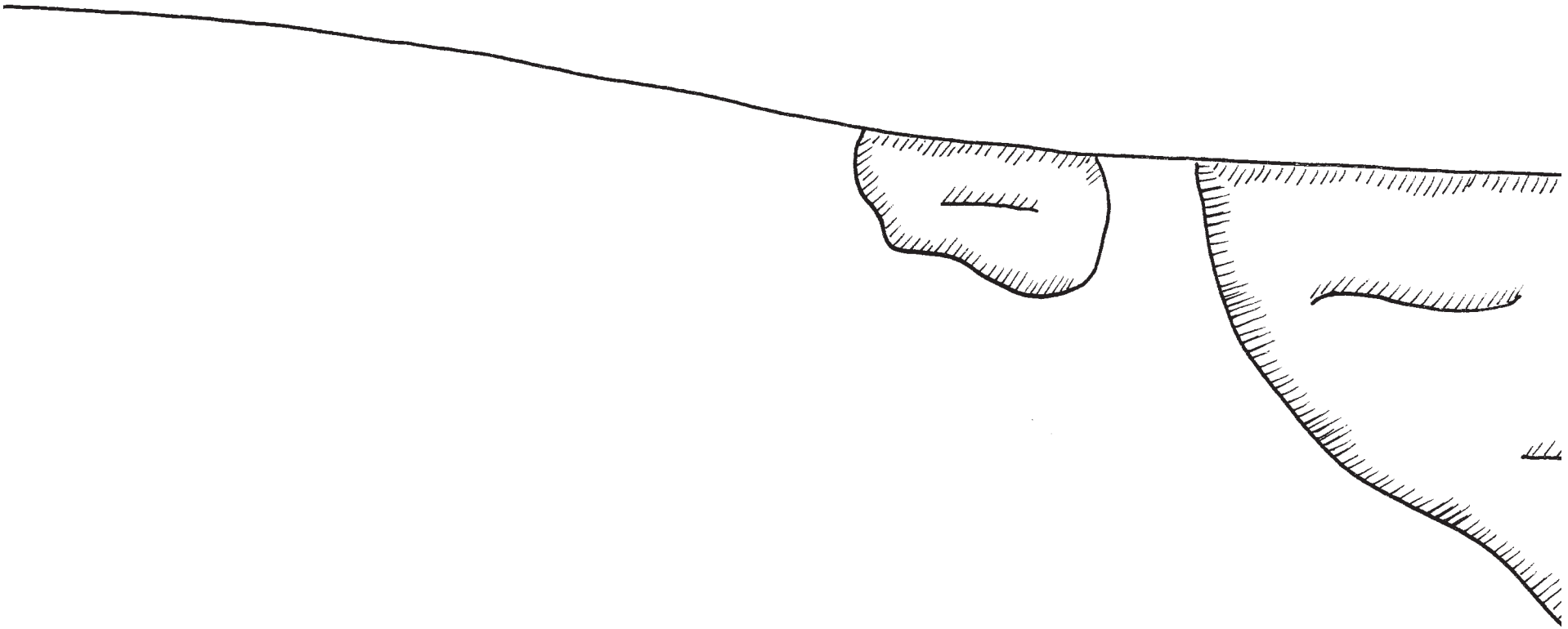
In this activity, students cut out estuary plants and animals and glue them onto the correct habitat.

Concepts: A *habitat* is a place where a plant or animal lives. Different plants and animals live in different habitats. Estuaries have many different habitats. This activity shows the rock, mud, and water habitats.

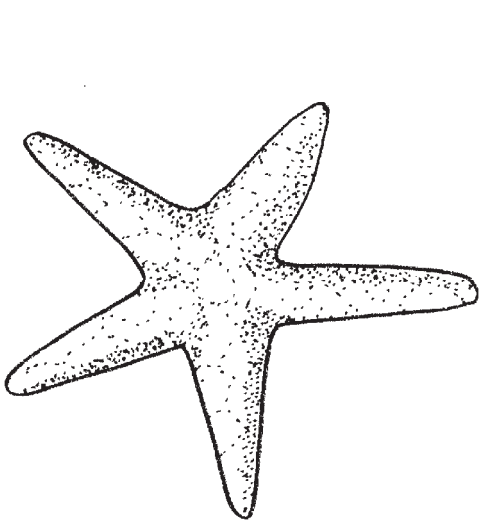
Discuss habitats with your students. Begin with familiar habitats such as a forest, pond, or backyard. What plants and animals live there? Why do they think different plants and animals live in different habitats? Imagine how silly a plant or animal would be in the wrong habitat.

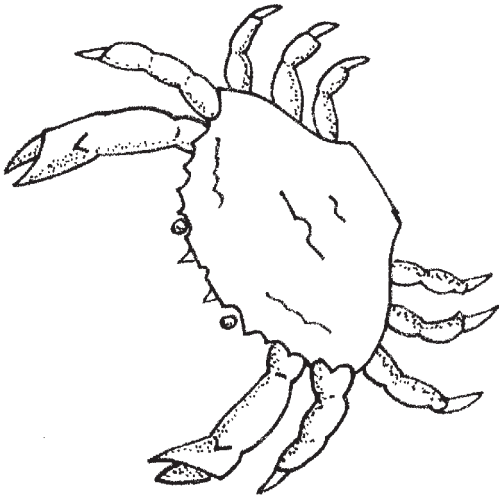
Talk about animals at the beach. What lives in the water? What lives on or under rocks? Could a barnacle live at a beach where there were no rocks? Make a list of possible estuary habitats (eelgrass, mud, cobble, rocks).

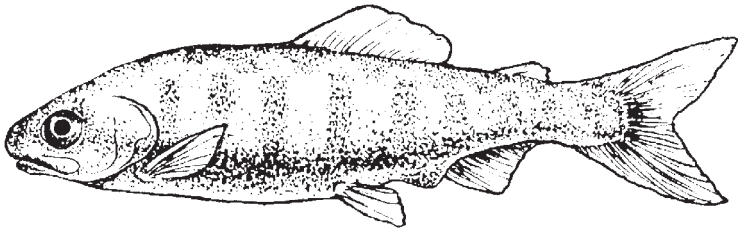
Color and cut out the estuary animals and glue them in the right habitat. There are two sets of animals included here. Choose the one appropriate for your students. Students can use the habitat background on the next page or make their own on a large sheet of paper.

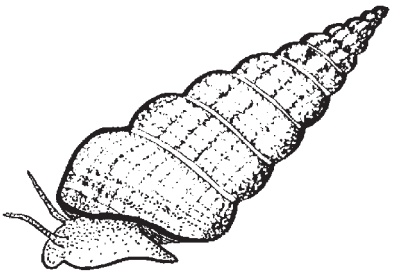


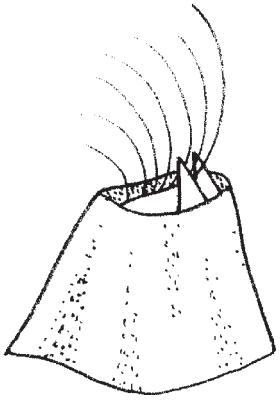
Where Is My Home?











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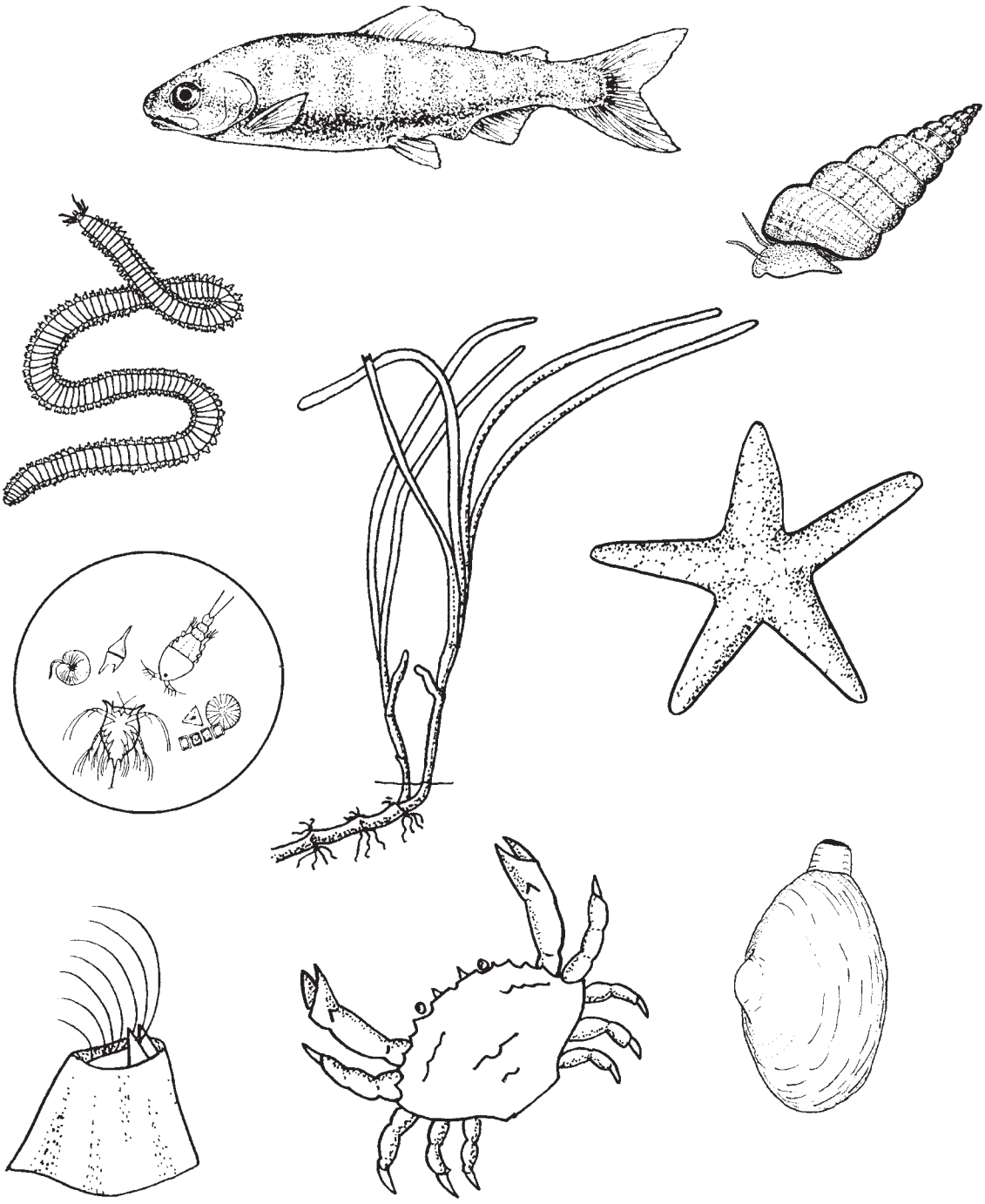


Estuary Birds

In this activity, students become familiar with different kinds of birds that can be found in estuaries like Padilla Bay -- birds they are likely to see on their field trip. They color the Estuary Birds page and may add more birds (and themselves), if they like.

Many birds use estuaries for protection and food. Each is very specialized with adaptations for its particular environment and food preference. Birds' beaks, feet, body shape, etc., tell us about how they live.

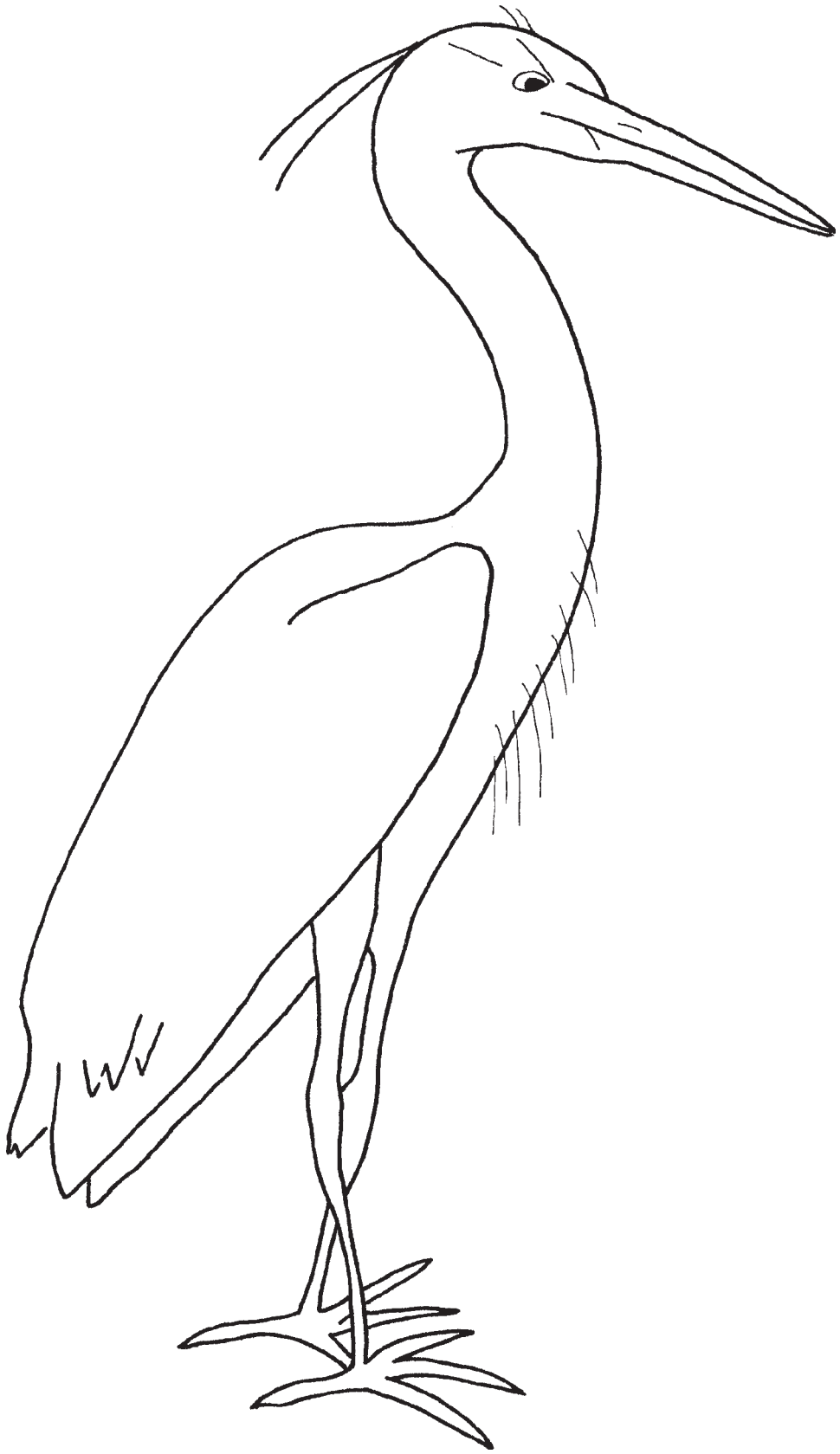
Tape or pin the four bird drawings in front of the class. Talk about the differences. Guess where you might see them and what they might eat. Talk about specific adaptations such as long legs, sharp talons, webbed feet, long beaks, and curved beaks. Why would these adaptations be useful? Can they name the birds? Have students color the *Estuary Birds* page and add other birds they think they may see. The following information may be useful in your discussion.

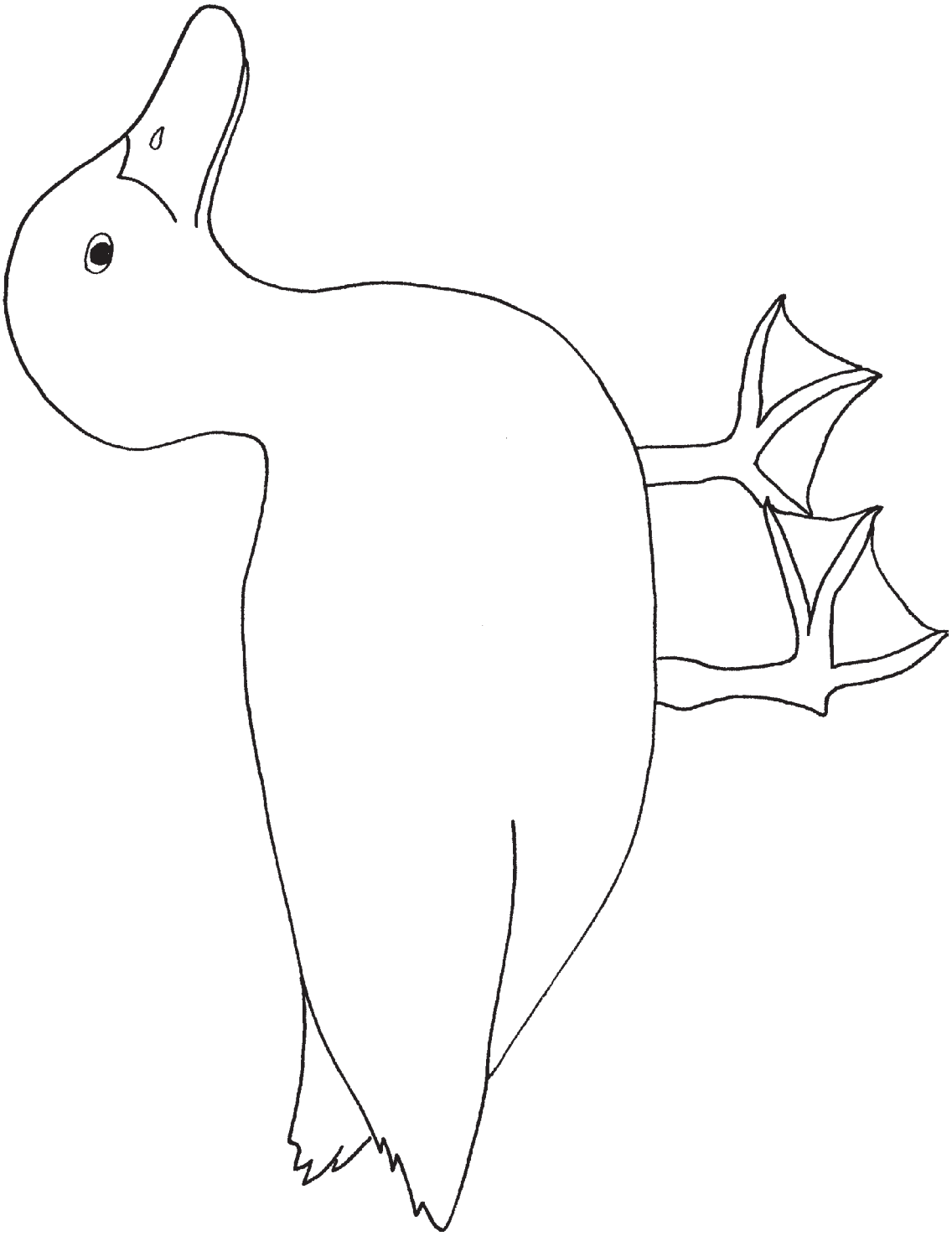
Eagles are one of the largest birds in North America. They are often seen perched in tree tops or soaring with wings outspread. They eat most types of fish as well as ducks, rabbits, turtles, and other small animals. They also eat carrion. Adults get their characteristic white head and tail at 4-5 years of age. Immature birds appear dark.

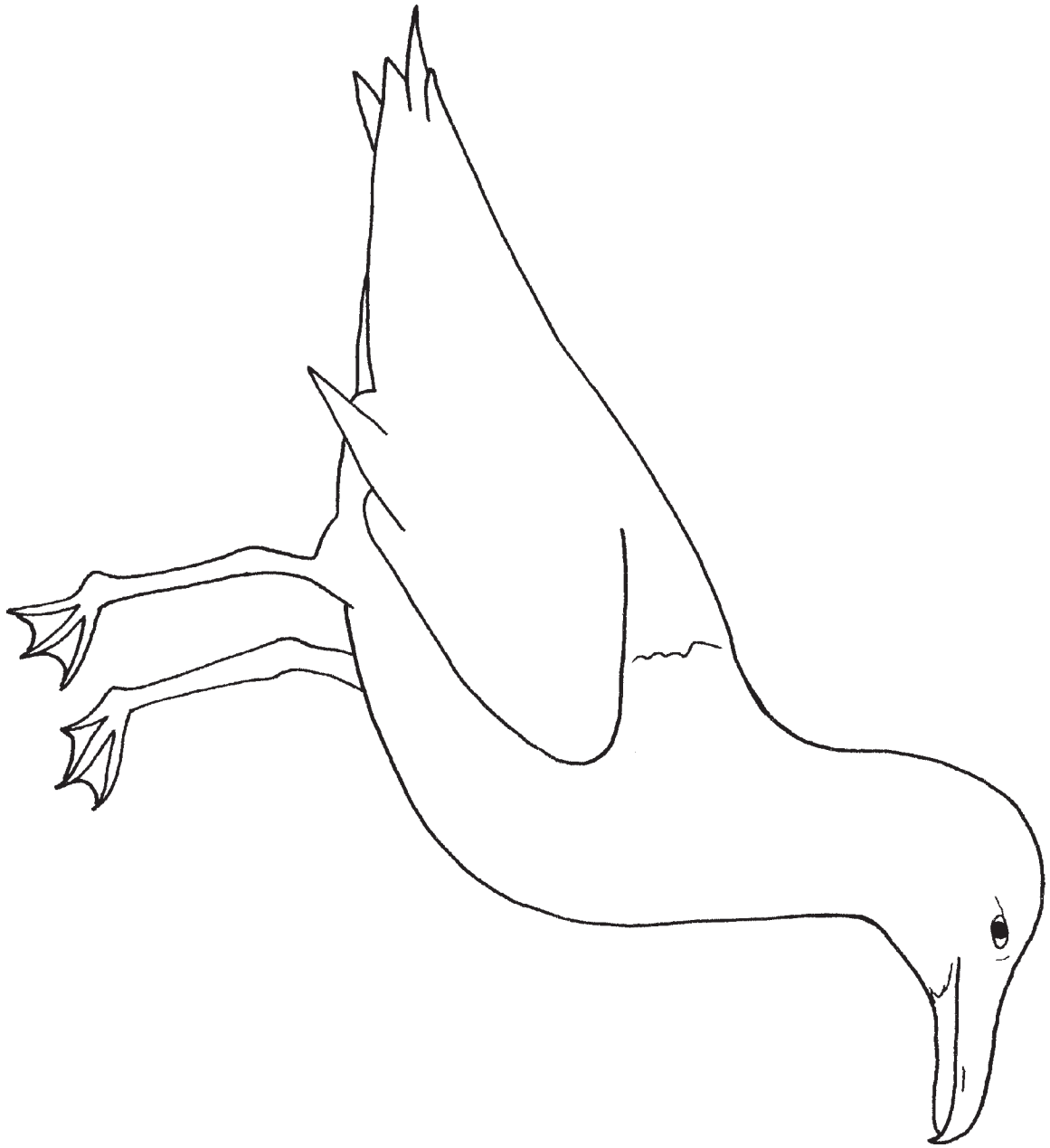
Great Blue Herons stand 3-4 feet tall. They fly with a slow wing beat and legs stretched out behind them. When flying and often while standing, they fold their long neck up into an "S" shape. They can stand almost motionless in the water when hunting for a meal of fish or crab.

Ducks are here by the thousands from October through April. Places like Padilla Bay are their wintering grounds. Their rapid wing beats can often be heard when they fly overhead. There are many different kinds of ducks. Some eat plant matter, some eat fishes and some dive for clams and crabs on the estuary floor.

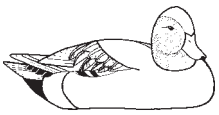
Gulls are well known to most of us. These striking grey and white birds frequent shores, the open ocean, inland waters and garbage dumps! Though they often scavenge dead things or garbage, you may observe a gull cracking open a clam shell by dropping it onto a rock below. Young gulls look dirty grey.

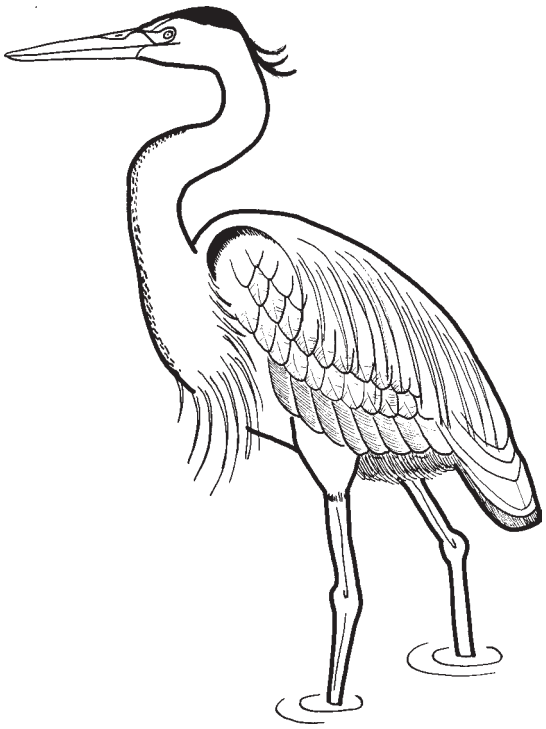


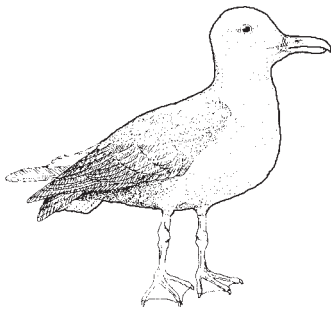




Estuary Birds







Vocabulary

estuary: a place where fresh water mixes with salty sea water. All of Puget Sound is an estuary.

fresh water: water without salt in it, like in rivers and lakes.

salt water: water with salt dissolved in it, like ocean water.

habitat: the place where a plant or animal lives.

tides: the rise and fall of ocean water twice a day.

plankton: plants or animals floating in the water -- usually microscopic.

phytoplankton: microscopic plants floating in the water.

zooplankton: (ZOE-plank-ton) microscopic animals floating in the water.

microscopic: too small to see without a microscope.

detritus: (dee-TRY-tis) rotting bits of plants and animals.

filter feeder: an animal, such as a clam or oyster, that strains food from the water.

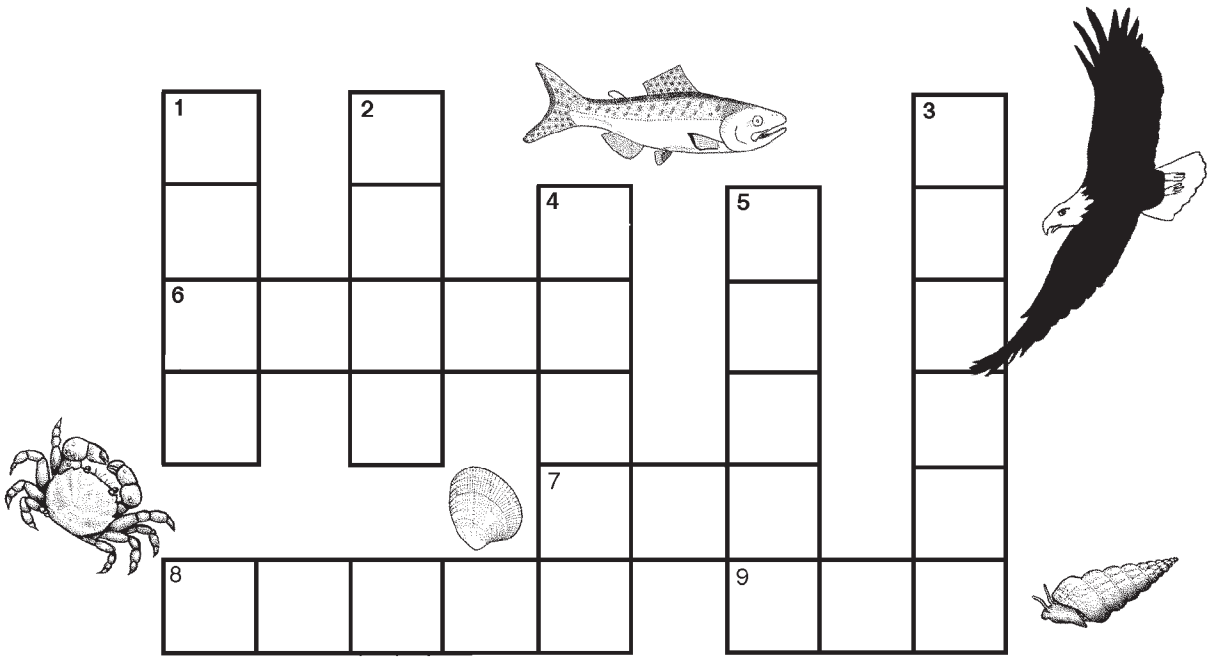
food chain: a sequence or "chain" of living things in a community, based on what eats what: for example, gull eats clam and clam eats plankton .

food web: overlapping and connecting food chains.

watershed: the area of land that drains into a body of water like a river or bay.

migration: seasonal movement of an animal from one place to another.

Who Am I?



Words to Use
salmon
birds
clams
crab
fish
mud
snail
sun
tides

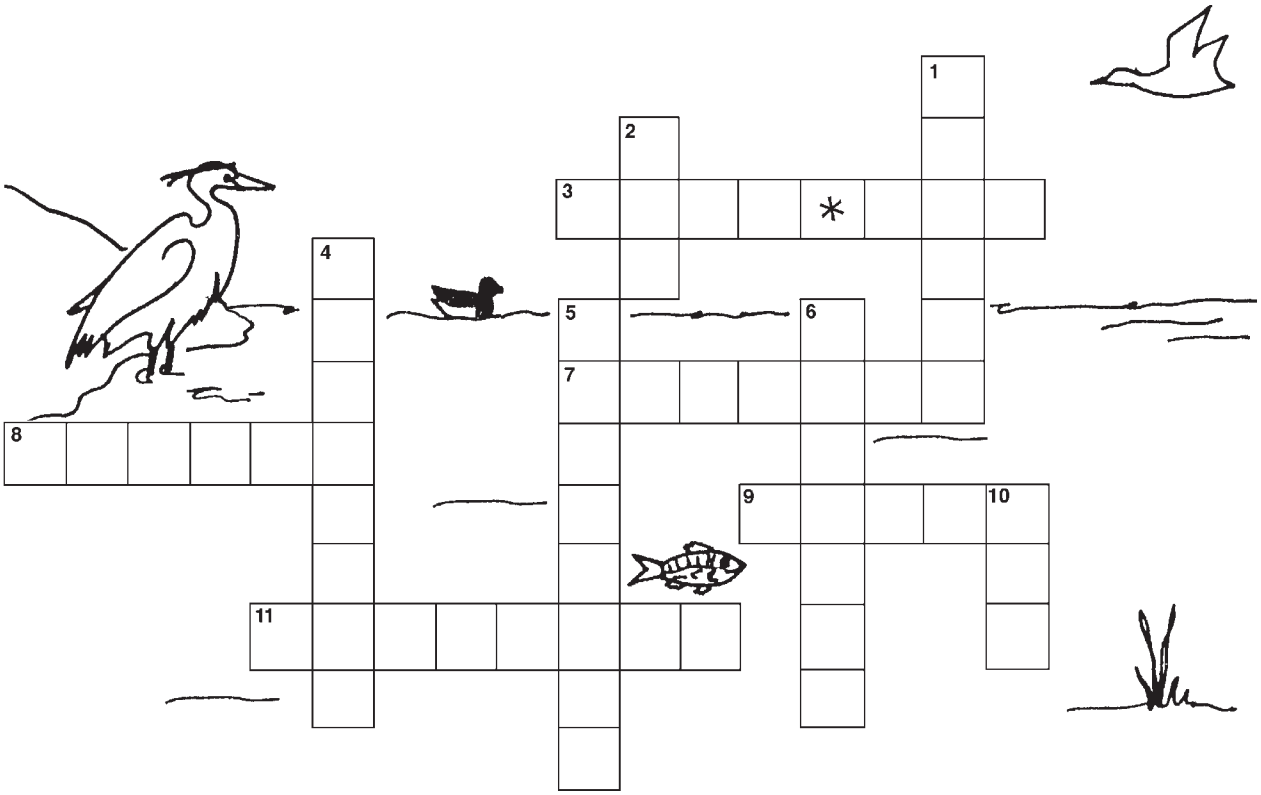
Across

6. I move VERY s-l-o-w-l-y.
7. I am home for clams and worms.
8. We go up and down in the bay twice every day.
9. I shine and give energy to all the plants.

Down

1. I have fins, scales, and gills.
2. I have 2 big claws and many legs.
3. I swim down the river to the estuary when I am a baby.
4. We have 2 shells and live under the mud.
5. We fly to the bay to look for food.

Crossword



Across

3. Many food chains connect to make a ____ ____.
7. The place where a river meets the sea
8. This animal goes from salt water to fresh to lay eggs.
9. The rise and fall of ocean water twice a day
11. Floating plants and animals

Down

1. Plants get this from the sun.
2. Floating animals are called ___-plankton.
4. An animal that attaches to rocks and eats plankton
5. Rotting bits of plants and animals
6. The place where an animal lives
10. The salt water in an estuary flows in from the ___.

Words to Use

plankton
sea
barnacle
estuary
habitat
food web
zoo
tides
detritus
salmon
energy

Word Search

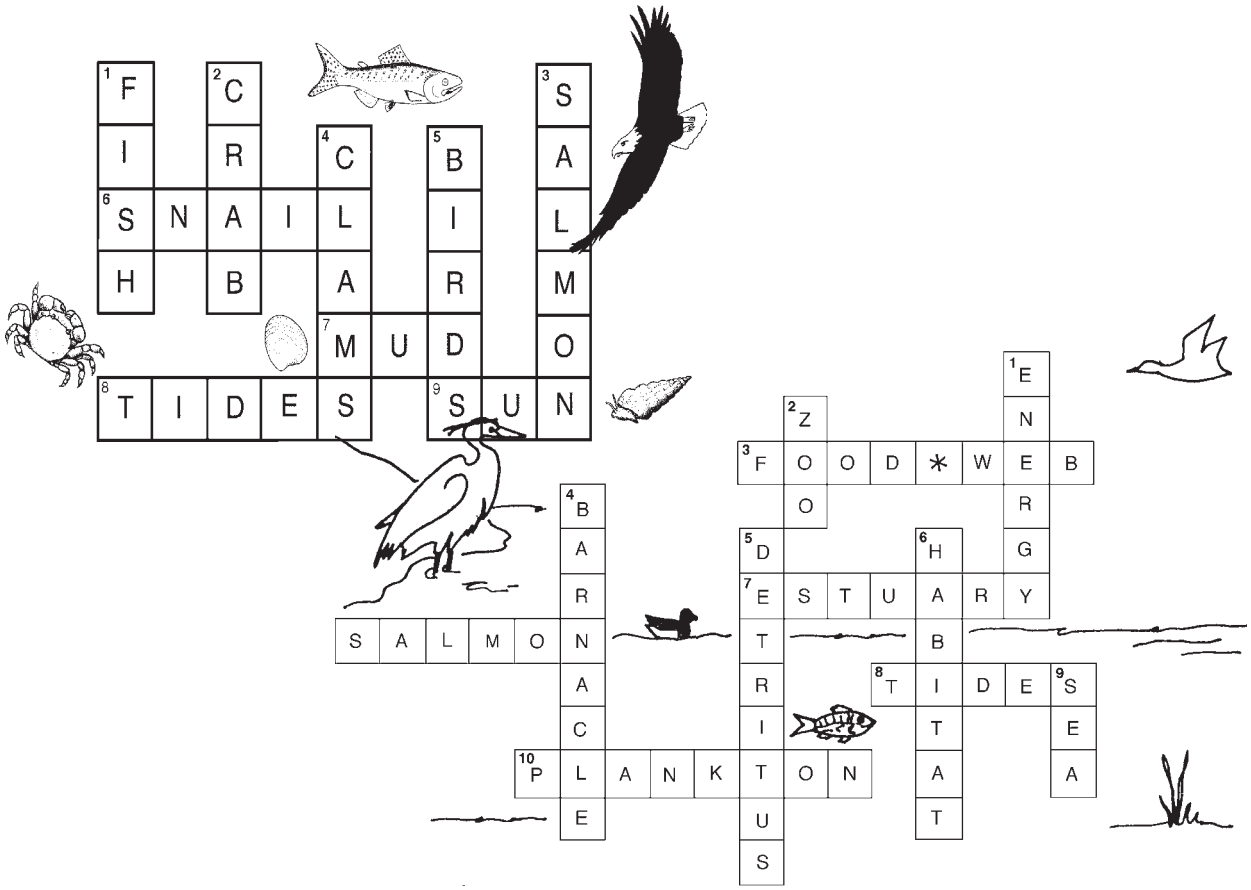
M L F E S T Z B X E C T E A P
I Y T O E R U E S I M B I L H
G T S E O N K C P E N E R G Y
R S R S T D I O S T A W I R T
A E R T S U C H A G P D Q U O
T R G U K S X H F I R O T S P
I S W A O C B T A Y U O N K L
O O T R S C F T Z I L F X V A
N A C Y Z O O P L A N K T O N
I I C T R Y T S P E E A P T K
M I C R S E E R E C T E P Z T
H A B I T D E T R I T U S X O
S U T R I F E C B Z Y S E W N
T Z U T O P L A N K T O N W P
H I T R W M H E L G J B Y I X

Find each word and match it with the correct definition.

____ 1. plankton
____ 2. food chain
____ 3. habitat
____ 4. estuary
____ 5. microscopic
____ 6. tides
____ 7. zooplankton
____ 8. migration
____ 9. food web
____ 10. phytoplankton
____ 11. detritus

A. A place where fresh water mixes with salt water
B. Rotting bits of plants and animals
C. What eats what in a community
D. When a group of animals moves from one place to another
E. Plants and animals that float freely in the water
F. Overlapping and connecting food chains
G. The place where a plant or animal lives
H. Something too small to see without a microscope
I. The rise and fall of ocean water twice a day
J. Animals floating in the water
K. Plants floating in the water

Key



E 1. plankton
C 2. food chain
G 3. habitat
A 4. estuary
H 5. microscopic
I 6. tides
J 7. zooplankton
D 8. migration
F 9. food web
K 11. phytoplankton
B 12. detritus

M	L	F	E	S	T	Z	B	X	E	C	T	E	A	P
I	Y	T	O	E	R	U	E	S	I	M	B	I	L	H
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T	Z	U	T	O	P	L	A	N	K	T	O	N	W	P
H	I	T	R	W	M	H	E	L	G	J	B	Y	I	X